

State of Thermal

Does thermal simulation software suit the needs of today's engineers?



Introduction

Last year, 6SigmaET launched The Heat is On - an in-depth study into the priorities and attitudes of electronics engineers around the world. This research found that despite engineers' focus on product reliability, many were still failing to adequately manage the thermal performance of their designs.

The findings also highlighted that companies often leave thermal considerations until the final stages of their projects, with over a quarter not testing the thermal reliability of a design until after it is complete.

Building on these findings, we at 6SigmaET wanted to examine in more detail the processes of thermal analysis currently being used by today's thermal engineers. In this survey involving a group of 171 engineers who specifically work in thermal management of electronics, 110 were identified as using thermal simulation tools across their projects.

This report provides an insight into these thermal professionals: examining their attitudes towards thermal simulation, how easy it is for them to run simulations successfully, and whether they have the right tools to support them. Through these questions, our State of Thermal report provides invaluable insight into the changing face of thermal analysis in 2017.

Who should read this report?

- **Thermal engineers** looking to explore the views and demands of their peers
 - **Manufacturers and businesses** looking to drive efficiency across their designs
 - **Product designers** looking to understand how thermal issues can damage their processes
 - **Those looking to invest in or explore new thermal simulation software**
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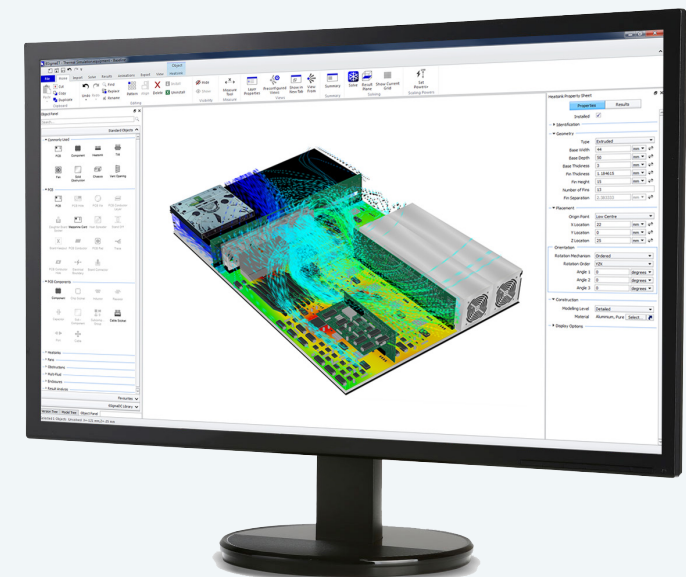
Our sample

This report incorporates research from 117 engineers with a focus on thermal management and design. The engineers were primarily sourced from the database of Thermal News – a popular online magazine for those working in the thermal electronics industry.

Of the 171 engineers surveyed, 110 were identified as using thermal simulation products. These products included Icepak, Fluent, Flotherm, FloEFD, 6SigmaET, Solidworks Flow Solutions, and several other leading brands.

Thermal simulation users included in our study:

Icepak	FlothermXT	Solidworks Flow Solutions
Fluent	FloEFD	AutoDesk CFD
Flotherm	HeatDesigner	6SigmaET

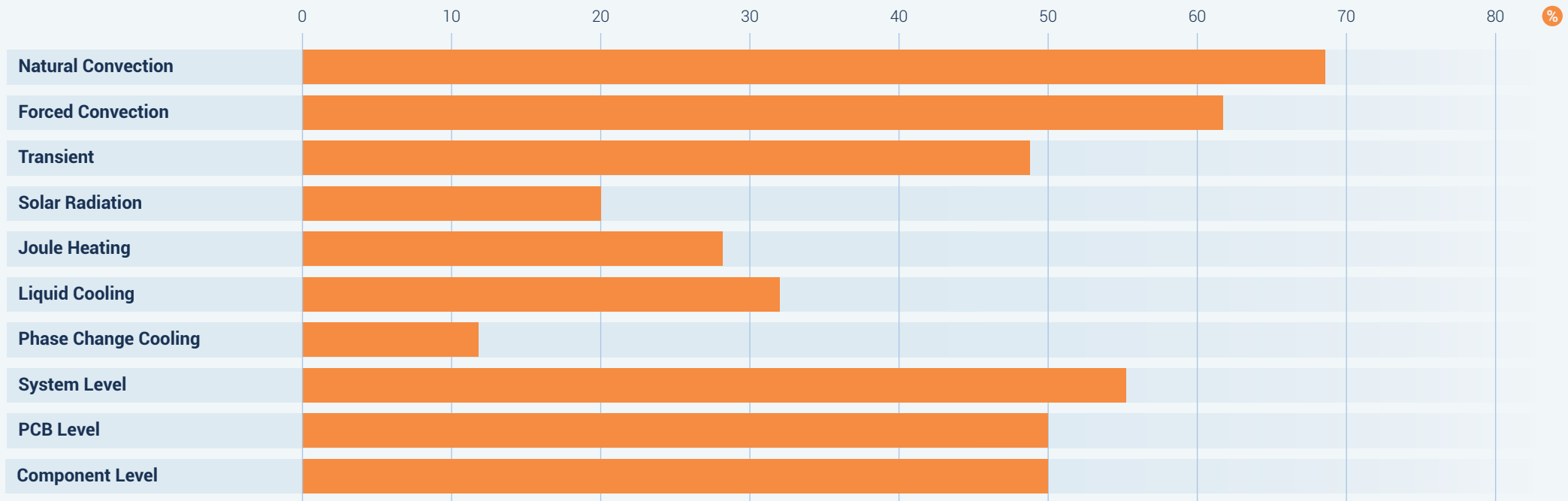


What types of thermal analysis are engineers performing?

The majority of thermal engineers are currently using simulation to analyze the impact of natural convection on their designs. Within many industries, this is because adding forced convection - such as liquid cooling or fans - isn't possible due to various constraints, e.g. size and cost.

There are also a significant number who are now attempting to work with transient analysis – examining how temperature may change over time (e.g. after additional components are switched on, fans fail, or power throttling occurs).

This type of analysis is significantly more complicated, involving much larger data sets. Clearly, today's thermal engineers aren't holding back when it comes to their analyses – they are examining potential thermal issues in much more detail, and expecting their hardware and simulation packages to keep up.



Challenges

Despite the majority of those surveyed using thermal simulation tools, only 29% of thermal engineers claim to be completely satisfied with their current simulation packages. In many cases, this comes down to a lack of documentation and support: only 37% of engineers state that they are completely satisfied with the support offered by their simulation provider, and only 20% claim to be completely satisfied with the associated supporting documentation.

As will be explored later in this report, many engineers find their tools limited, difficult to understand, and time consuming to use. Dissatisfaction also comes down to the cost involved in purchasing and maintaining a thermal simulation package, with nearly a quarter of engineers (24%) saying that they are either somewhat unsatisfied or completely unsatisfied with the cost of their current thermal simulation solution.

While cost is clearly an influencing factor, this dissatisfaction may arise because engineers are unwilling to pay for something when they do not feel they are getting the best possible results. As such, they may not feel they are receiving enough return on their investments – particularly if their personal usage doesn't fully utilize what a simulation tool can do.



71% of thermal engineers are not completely satisfied with the support offered by their thermal simulation tools



1 in 4 of thermal engineers are dissatisfied with the cost of their current simulation package

What's holding today's engineers back?

One of the biggest frustrations facing thermal simulation users is the time involved in importing CAD, building models and solving. According to our research, only 37% of engineers spend less than an hour building their models, while 30% have to spend over a day. Once this design stage is complete, 39% spend more than an hour defining properties, while 23% must spend over an hour setting boundary conditions. 41% also say that they will typically spend over an hour gridding their design, while 10% will spend more than a day.

All of these tasks add significantly to the total simulation time, and that's before engineers have even attempted to solve their designs. The solving stage is typically perceived as one of the slowest in the simulation process.

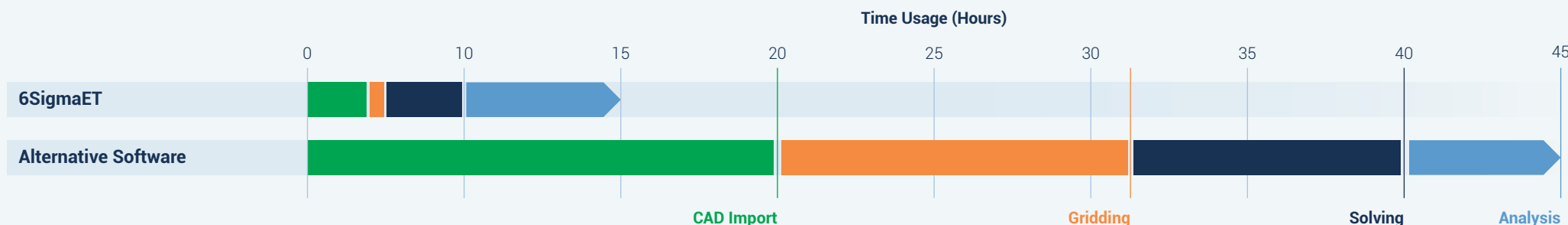
While accurate simulation will never be a quick task, the reality is that many engineers are spending longer than necessary because of slow or poorly designed thermal simulation software packages.

As just one example, 66% of thermal engineers spend up to a day or more solving their simulations – and yet 14% say that they can do this in under 30 minutes. Similarly, 39% must spend over an hour importing CAD data, while 24% claim to be able to run the same task in under 10 minutes.

These discrepancies highlight the significant differences in usability and solve time offered by different thermal simulation packages.

Rohde & Schwarz: A Time to Solution Comparison

In a side-by-side comparison conducted by Rohde & Schwarz, 6SigmaET was found to provide faster preparation time, faster pre-processing and faster solving times than a comparable thermal simulation software. This meant a total increase in efficiency of 35%.



It's complicated

In many cases, the additional time taken to perform simulation tasks is not down to slow software, but is a result of unnecessary complexity and poor user interfaces.

Of those surveyed, nearly a fifth (18%) struggle when it comes to the gridding/meshing of their designs. This may be down to a lack of automation across many thermal simulation suites, with engineers often being forced to repeatedly alter their grids manually to improve the accuracy of their simulations. Currently, 61% of engineers must modify their grids to increase accuracy, while 34% claim that they must regularly create a grid from the beginning.

While there are clearly time issues throughout the simulation process, the task of building and developing component models is generally considered the most straightforward part. 69% of thermal engineers say that they find it easy to build models, while 71% find it either easy or very easy to set boundary conditions for their designs. However, 51% would still like to speed up the model creation process.



18% of thermal engineers struggle with the complexity of applying a grid to their designs



34% of thermal engineers must regularly create a grid manually from the beginning

A hard time with hardware

Thermal engineers are also struggling to adopt the hardware necessary to support today's resource-intensive thermal simulation software packages. Given the nature of the coupled non-linear equations that must be solved, most software requires a significant amount of processing power to generate accurate results quickly.

At present, 22% of thermal engineers say that their organizations are unable to keep up with the hardware requirements needed to run a thermal simulation. As a result, 24% find themselves compromising on the accuracy of their designs due to hardware limitations.

While there is upfront expense involved in providing this hardware for simulation, 36% of respondents state that – rather than investing in expensive on-premises hardware – their organizations would benefit from the ability to solve their thermal designs via the cloud. However, currently only 2% of thermal engineers use the cloud for solving their simulations.



Laptop

25%



**Desktop PC/
Workstation**

81%



**Dedicated
Server**

15%



**HPC
Cluster**

9%



Cloud

2%

Solving in the cloud

With any thermal simulation, significant computing power is required to solve the complex CFD (computational fluid dynamics) equations used to calculate temperature and airflow.

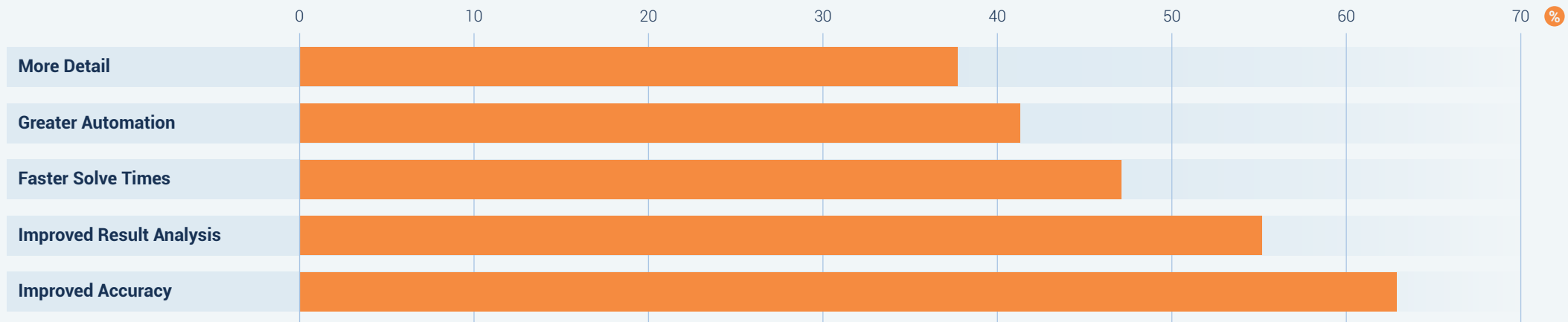
Traditionally, this required a substantial up-front investment in high performance computing hardware. By taking advantage of cloud computing platforms, however, thermal engineers can significantly reduce their hardware requirements and instead “pay as you solve”.

At 6SigmaET, we have partnered with high performance cloud computing platform Rescale specifically to help engineers overcome hardware challenges. Through this partnership, 6SigmaET users gain access to as much as 1,400 petaflops of computing power delivered via Rescale's 30 data centers and over 8 million servers.

What do thermal engineers want?

Despite their frustrations, our findings suggest that thermal engineers know what they want from simulation software. According to our research, 63% of thermal engineers would like to improve the accuracy of their simulations, while 46% want to find ways to speed up solve times. 41% would also like to see greater automation in the optimization of their designs.

What do thermal engineers want from simulation software?



Making the switch

As this analysis has shown, today's thermal engineers are quite open about the flaws and frustrations that are built into their existing thermal simulation packages: from slow solve times and complex user interfaces to limited automation and a lack of cloud integration. And yet, despite these flaws, most engineers will keep using their existing thermal simulation platforms.

Of those surveyed, 40% have never switched to an alternative simulation tool, while a further 18% last switched tools more than 3 years ago.

For some, this may be due to a reluctance to disrupt their existing workflow in the short term; for most, however, it is a matter of habit. As a result of their reluctance to switch, many engineers are left believing that their legacy thermal simulation tools are the best that the market has to offer – potentially costing their organization time and money in the long term.

With so many engineers being forced to sacrifice accuracy because of hardware and software limitations, it's important to explore all available

options. Without trialing other tools, thermal engineers will never be certain that their existing approach to simulation is guaranteeing maximum reliability for their end products and designs.

This is not only bad news for engineers and manufacturers - it's bad news for the end customer.

Despite **71%** of thermal engineers not being completely satisfied with their simulation package, **60%** haven't switched provider in over 3 years.

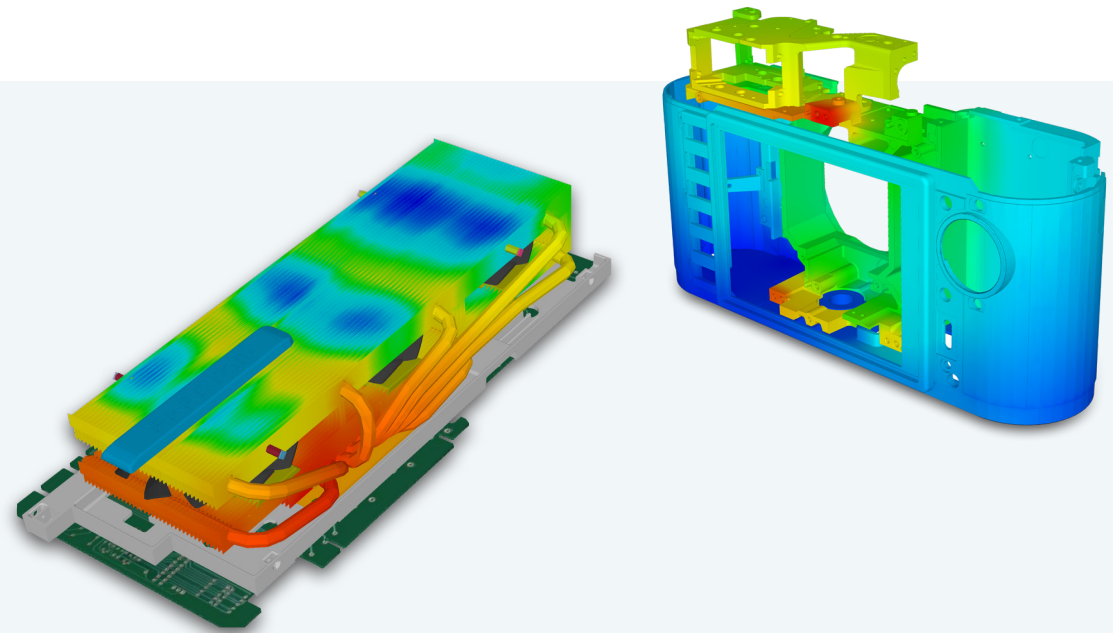
Conclusion: Time for a change?

Demands on thermal engineers are growing with increased complexity, more miniaturization, and increasingly urgent time and cost pressures.

Thermal engineers need reliable simulation tools that can assist them by providing accurate results quickly. These tools must provide a clear and intuitive user interface, and rapid design and solve times on a wide variety of hardware - including the ability to offload complex analysis to the cloud.

At present, however, many engineers rely on drastically out-of-date simulation software – software which often has not been replaced or significantly updated for years. As a result, many engineers are spending too long on thermal simulation and not getting the detailed results they require.

These engineers and businesses need to think beyond their legacy thermal simulation packages, and work with vendors that continue to innovate and push the boundaries of thermal simulation capabilities.



About 6SigmaET

This report was commissioned by 6SigmaET, a leading provider of innovative thermal simulation solutions. The 6SigmaET platform has been identified as one of the fastest thermal simulation software suites in the electronics sector, using a combination of cloud solving, unstructured gridding and intelligent automation to generate thermal simulations in a fraction of the time of older, legacy platforms.

To find out more about how 6SigmaET
can benefit your business, visit
<http://www.6sigmaet.info/whyswitch>